

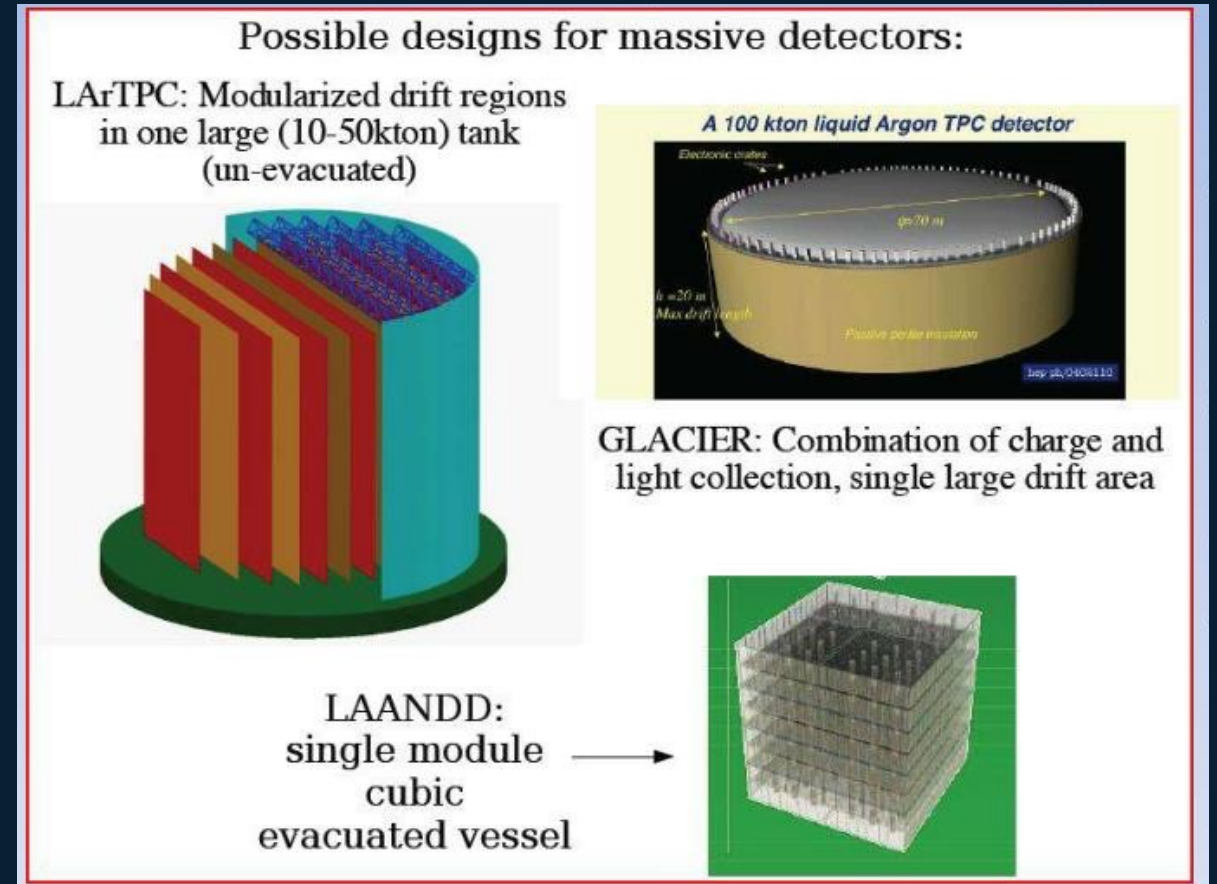
# HIGHLIGHTS AT BNL

JULY 5, 2022 – JULY 15, 2022

# THE LIQUID ARGON TIME PROJECTION CHAMBER

- Used in detector technology for Neutrino research
- Argon's large mass and relatively high density make for reasonable neutrino interaction rates.
- Electronic devices are developed to be sustainable and operate at extremely low temperatures, since liquid argon is used in detector technology.

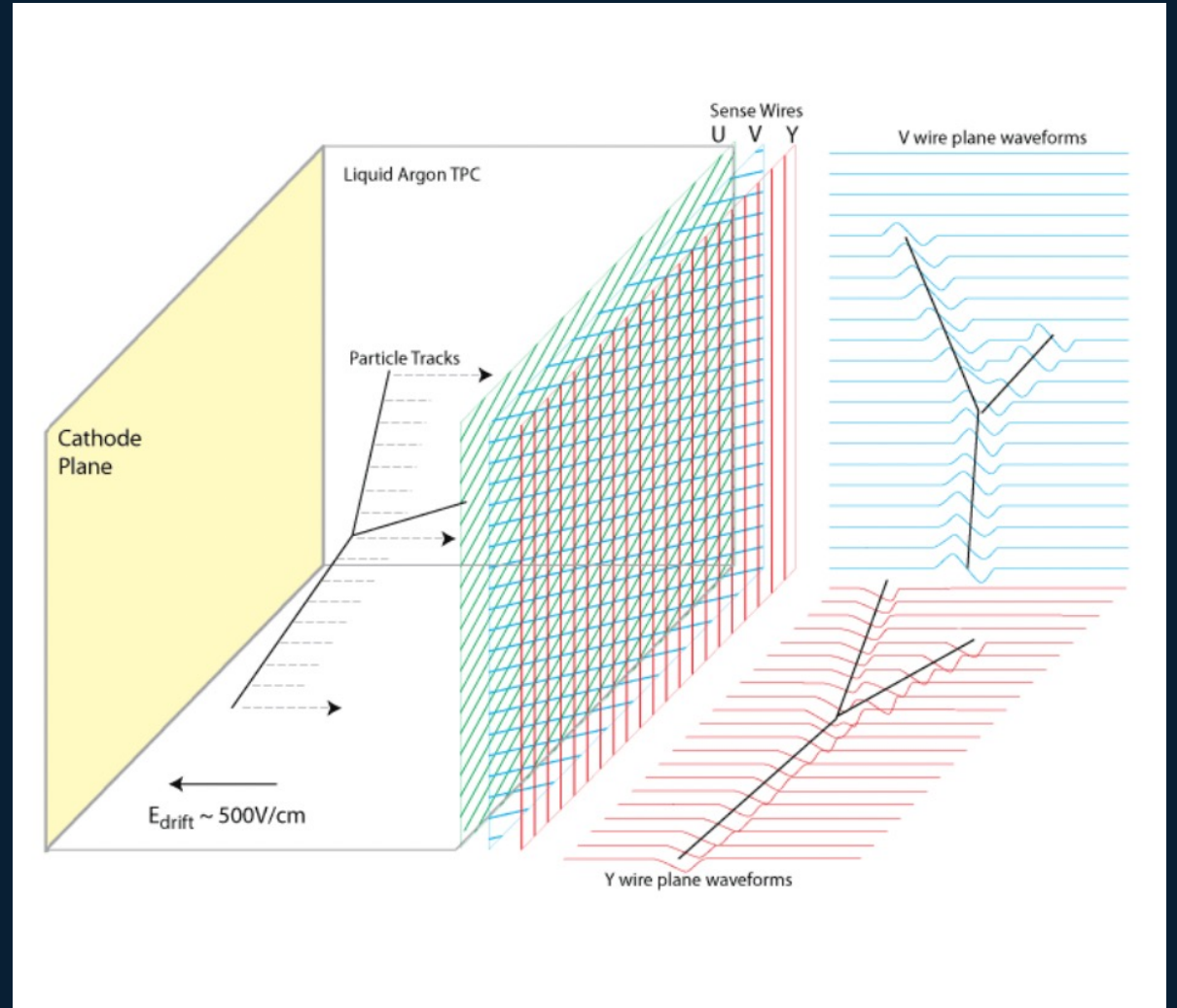
(COLD ELECTRONICS)





# THE LIQUID ARGON TIME PROJECTION CHAMBER

- Charged particles passing through detector ionize argon atoms and electrons from the atom are shot out.
- Waveforms are created on wire plates as ionized electrons travel across them

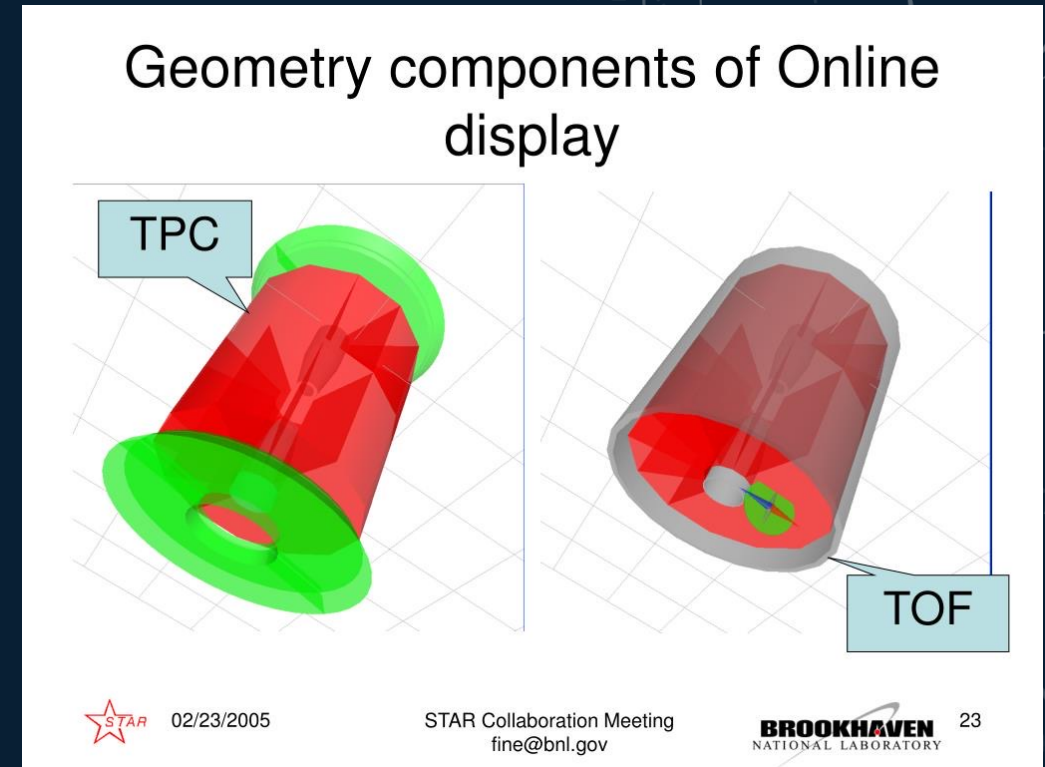
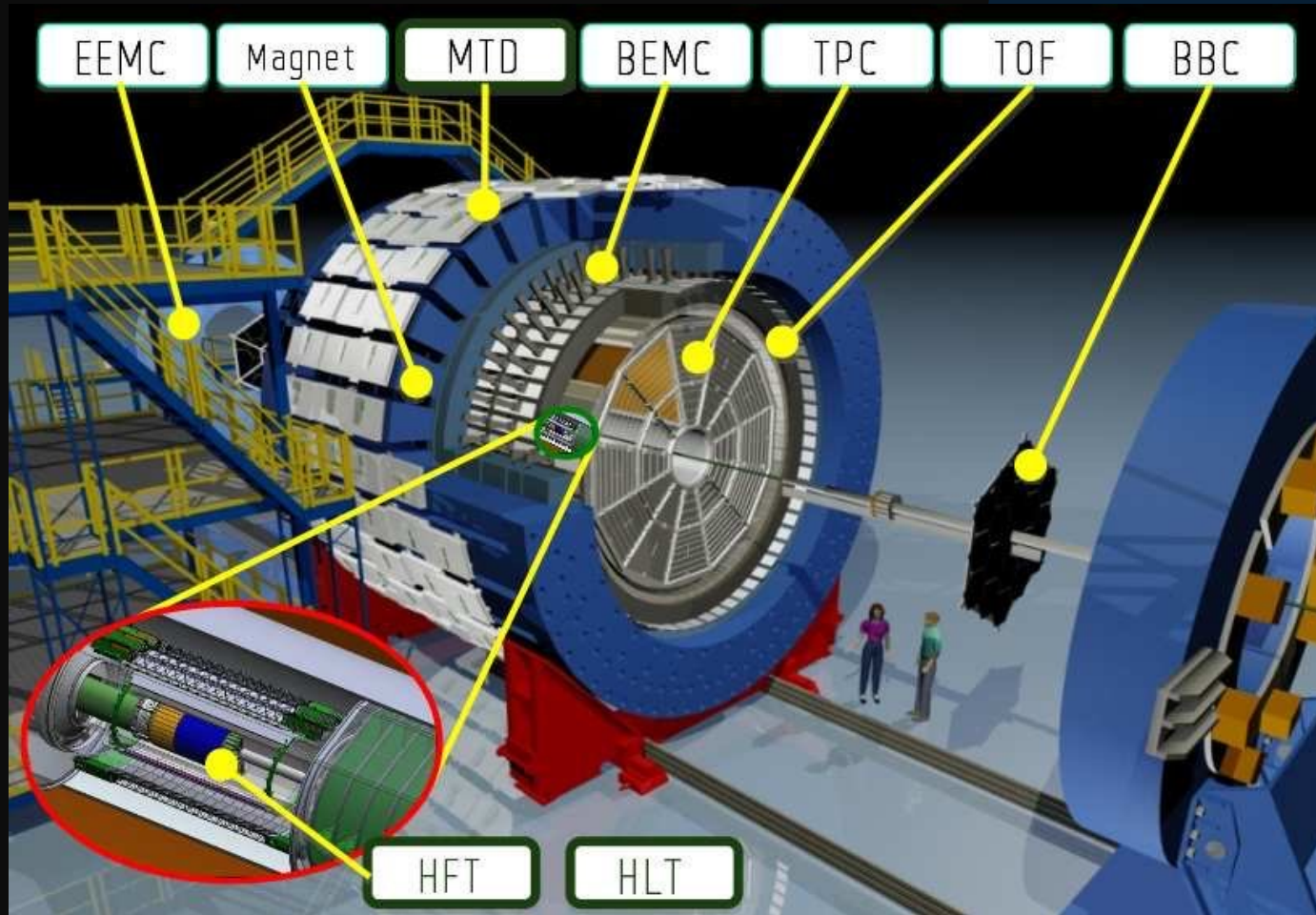






# THE STAR DETECTOR AT BNL

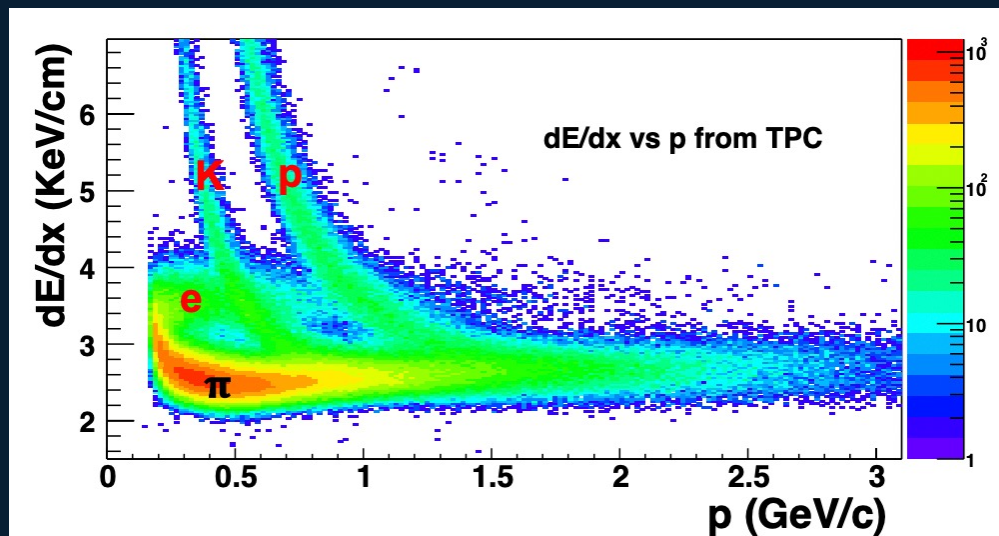




EEMC – The Endcap Electromagnetic Calorimeter, MTD – Muon Telescope Detector, BEMC – Barrel Electromagnetic Calorimeter, TPC - Time Projection Chamber, TOF – Time of Flight, BBC - , HFT – Heavy Flavor Tracker, HLT – High Level Trigger

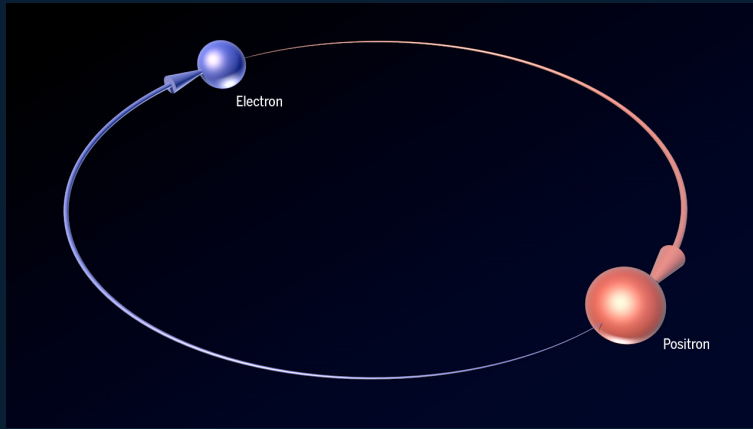


# THE STANDARD MODEL

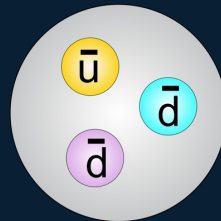
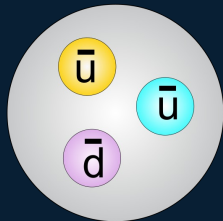


mass →	$\approx 2.3 \text{ MeV}/c^2$	$\approx 1.275 \text{ GeV}/c^2$	$\approx 173.07 \text{ GeV}/c^2$	0	$\approx 126 \text{ GeV}/c^2$
charge →	$2/3$	$2/3$	$2/3$	0	0
spin →	$1/2$	$1/2$	$1/2$	1	0
	<b>u</b> up	<b>c</b> charm	<b>t</b> top	<b>g</b> gluon	<b>H</b> Higgs boson
	$\approx 4.8 \text{ MeV}/c^2$	$\approx 95 \text{ MeV}/c^2$	$\approx 4.18 \text{ GeV}/c^2$	0	
	$-1/3$	$-1/3$	$-1/3$	0	
	$1/2$	$1/2$	$1/2$	1	
	<b>d</b> down	<b>s</b> strange	<b>b</b> bottom	<b><math>\gamma</math></b> photon	
	$0.511 \text{ MeV}/c^2$	$105.7 \text{ MeV}/c^2$	$1.777 \text{ GeV}/c^2$	$91.2 \text{ GeV}/c^2$	
	-1	-1	-1	0	
	$1/2$	$1/2$	$1/2$	1	
	<b>e</b> electron	<b><math>\mu</math></b> muon	<b><math>\tau</math></b> tau	<b>Z</b> Z boson	
	$< 2.2 \text{ eV}/c^2$	$< 0.17 \text{ MeV}/c^2$	$< 15.5 \text{ MeV}/c^2$	$80.4 \text{ GeV}/c^2$	
	0	0	0	$\pm 1$	
	$1/2$	$1/2$	$1/2$	1	
	<b><math>\nu_e</math></b> electron neutrino	<b><math>\nu_\mu</math></b> muon neutrino	<b><math>\nu_\tau</math></b> tau neutrino	<b>W</b> W boson	

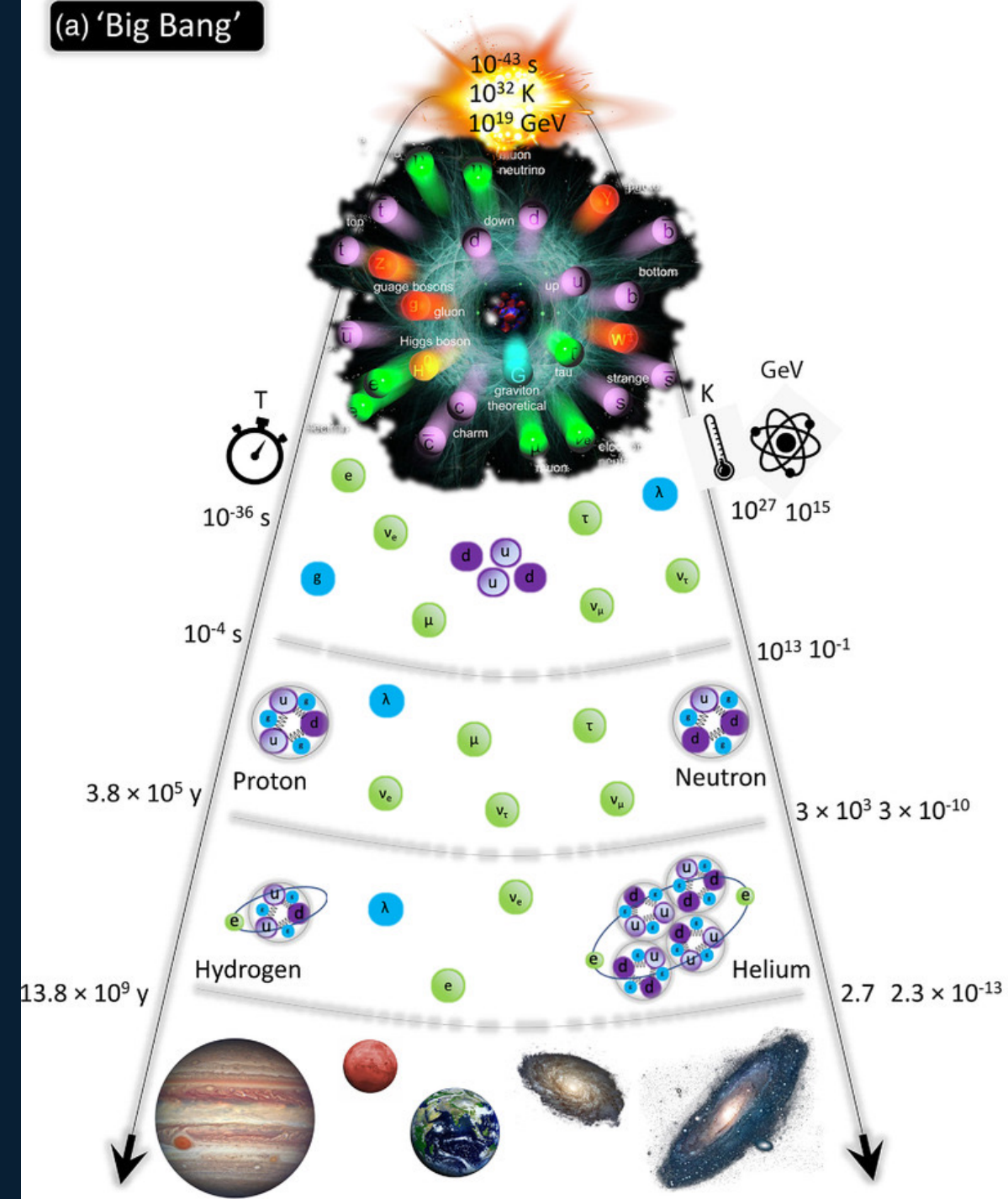




# SIMILAR DISCOVERY TIMELINES: MATTER VS ANTIMATTER

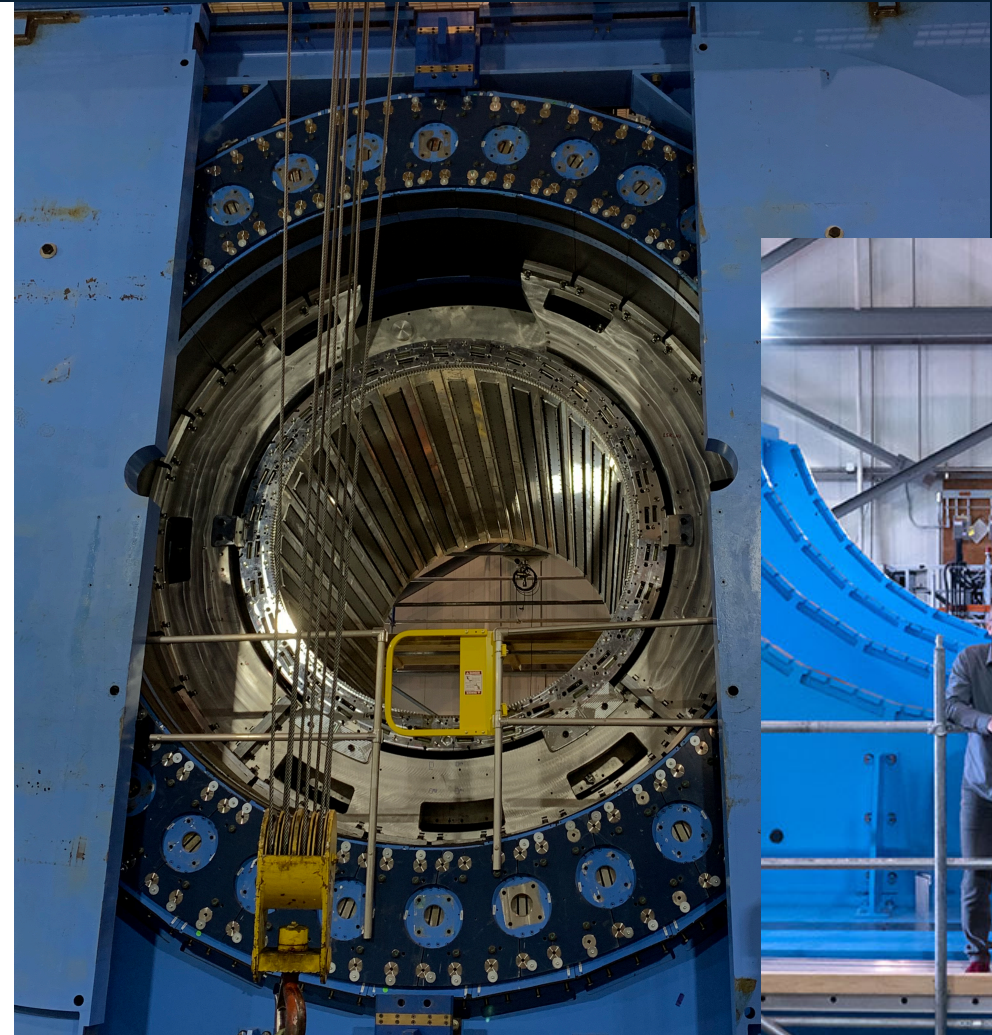
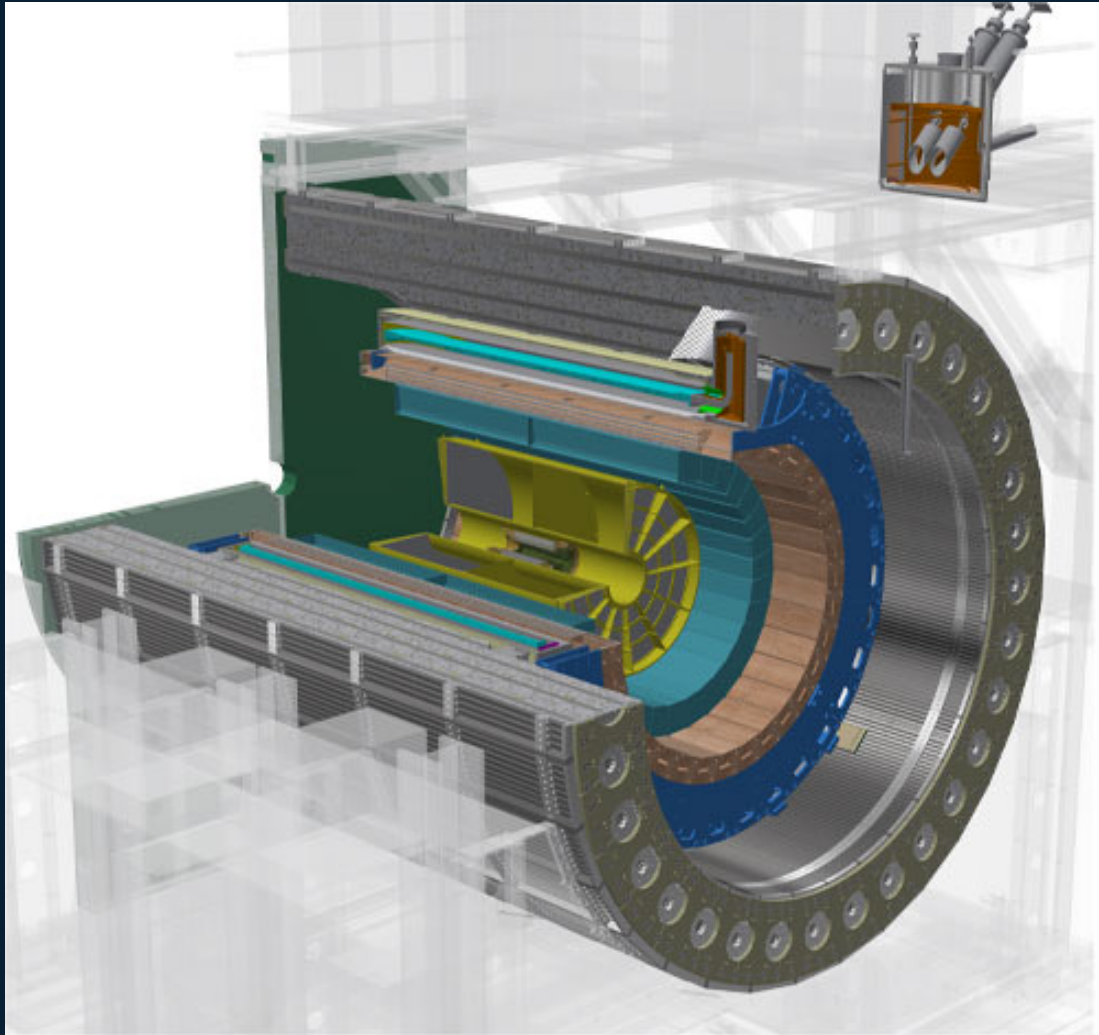


(a) 'Big Bang'

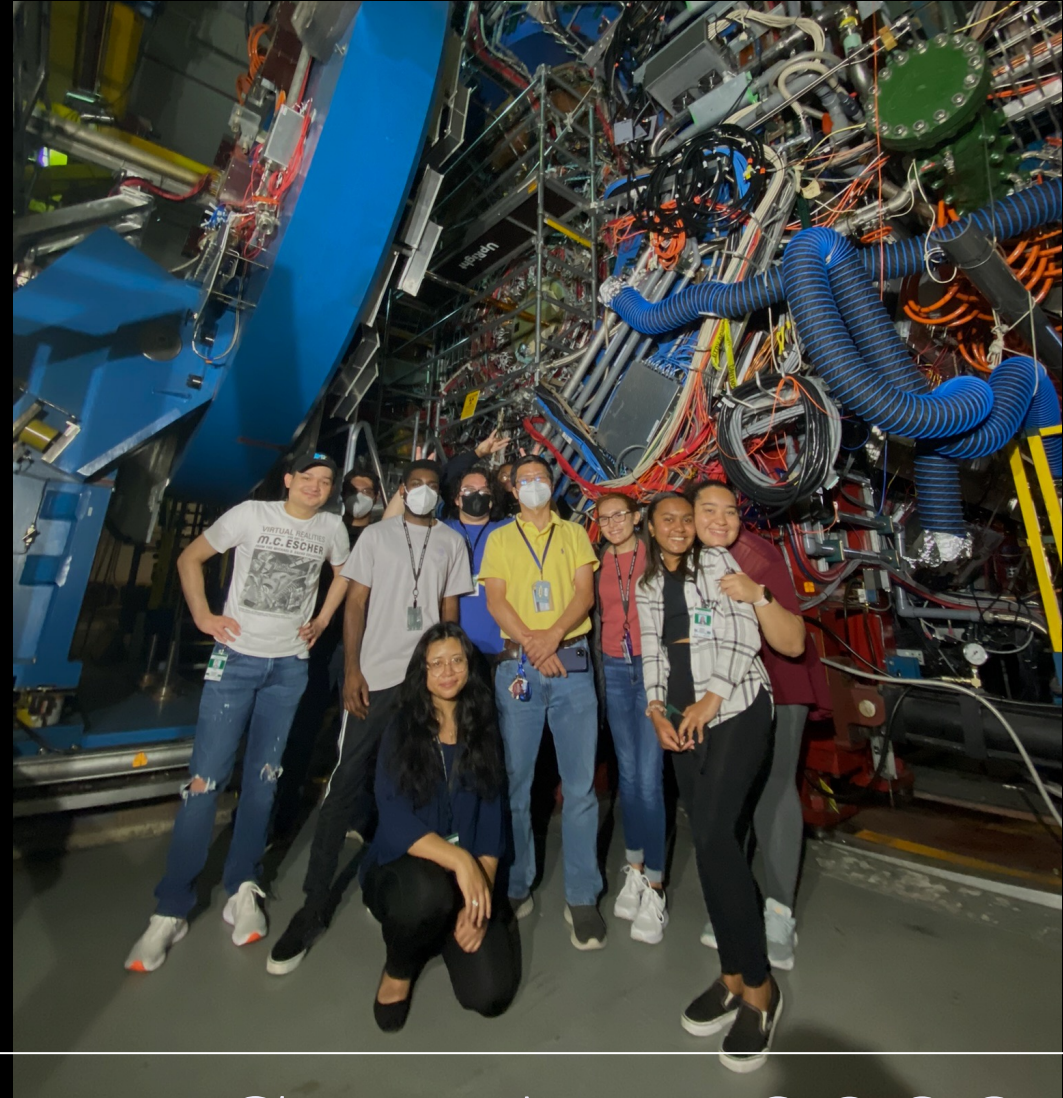
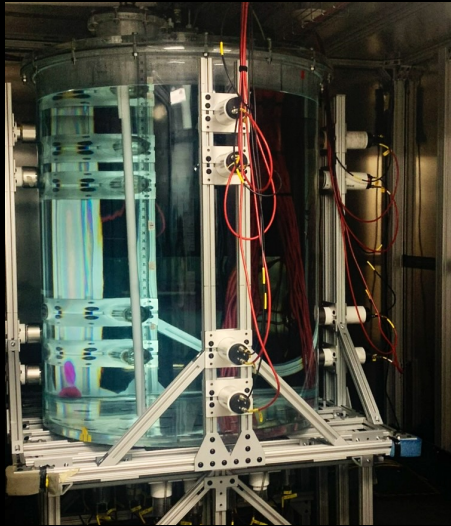




# sPHEONIX







NuSTEAM 2022